

Mecheleciv



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THE GEORGE WASHINGTON UNIVERSITY

MARCH 1962



revolution in space

This amazing structure symbolizes the outer space theme for this year's Century 21 International Exposition in Seattle, Washington. Called the Space Needle, it soars 600 feet into the air on three steel legs, tapers to a slim waist at the 373-ft. mark, then flares out slightly to the 500-ft. level, and is crowned by a mezzanine, observation deck, and a 260-seat restaurant that *revolves* slowly (one complete revolution an hour) while patrons enjoy their meals.

The Space Needle is a combination of sheer audacity and imagination with 3,500 tons of steel. Steel was chosen because it would be faster to erect, stronger per unit area, quickly available. A relatively new type of structural carbon steel called A36 was used because its greater strength (about 10%) permits higher design stresses, at the same time maintaining factors of safety, and because it could be easily welded. This is an example of the exciting materials and challenging projects engineers will find at United States Steel.

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United States Steel

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FOR ENGINEERS

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The Air Force also offers challenging jobs for engineers as civilians. Write to Directorate of Civilian Personnel, Hq. Air Force Systems Command, Andrews Air Force Base, Washington 25, D. C., concerning opportunities for individuals with degrees in aeronautical, electrical, electronic, and mechanical engineering. Write to Directorate of Civilian Personnel, Hq. Air Force Logistics Command, Wright-Patterson Air Force Base, Ohio, concerning opportunities for individuals with degrees in industrial engineering.



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VOL. 20

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NO. 4

ARTICLES

ON THE ORIGIN OF THE UNIVERSE

by Allyn Kilsheimer 4

INTRODUCTION TO PURE PNEUMATIC COMPUTERS

by Donald Miller 6

FEATURES

ALUMNI PAGE 8

ENGINEERS' DAYS 10

CAMPUS NEWS 14

MECH MISS 18

WHAT'S NEW 19

TENSION BUSTERS 24

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ON THE ORIGIN OF THE UNIVERSE



by Allen Kilsheimer

"The time has come" said the Walrus, "to speak of many things..." of stars and of nebulae; of origins and of ends.

Savants of the past have suggested that the universe was created in six days out of chaos by an all powerful God; created out of earth, air, fire and water by unknown means; grown from a germinating seed which came from the Great Unknown; and created by many other mysterious and awful means.

The religions of the ancients represent the first attempts of man's awakening intellect to find its place in the surrounding world. The Hebrews believed that an all powerful Supreme Being created the world from utter chaos in six days, putting the stars, sun and moon in the heavens. The Egyptians on the other hand, were convinced that the world was created by the God of the air, Shu, son of the Sun-God, Amon-Ra, who separated his sister, Nut, the sky, from his brother, Keb, the earth. The Babylonian, "Enuma Elish," creates the world from a watery chaos in which, through a series of Gods and Goddesses, are begotten Ausher and Kishor (the horizon) who gave birth to Anu, God of the sky, who in turn, gave birth to Nudimmud, the God of the earth.

It remained as a task for the more sophisticated Greeks to begin the liberation of cosmology from myth. The Milesian school of Thales and Anaximander, which culminated in the Atomist School of Democritus and Lucretius, provided the foundation which enabled the thinkers of the Renaissance to proceed with their work.

The Milesians of the 6th century B.C. (Thales and Anaximander) believed in a primal unity from which separated the powers; hot and cold; moist and dry. It is from this separation that the formation of the universe results: "...first of all chaos came into being, then the earth, then the night gave birth to the day, then the earth gave birth to the starry heaven.

The Milesians gave rise to the Atomists of the 5th century, of Lucretius, with their remarkably advanced theories of the nature of things. These progressive thinkers postulated a universe composed of indivisible atoms, boundless in space and infinite in time, containing innumerable worlds in various stages of evolution, whose order depended on a blind interplay of atoms. The view of the universe as truly a 'cosmos', or orderly pattern, and the demotion of the earth from the center of the universe by Aristarchus of Samos where the major contributions of the Pythagoreans to cosmogony.

HOMOCENTRIC SPHERES

Plato, Aristotle, and Ptolemy were the architects of the opposing cosmology which prevailed throughout the Middle Ages, with various modifications as made necessary by new observational data. This was the geocentric, finite universe. The Platonic universe consisted of a series of moving concentric spheres, with the motionless earth at the center. As time passed and additional observational data on the wanderings of the planets caused difficulties, Calippus and

Eudoxus, pupils of Plato, corrected and improved so greatly on the accuracy of Plato's scheme, that they added thirty-three more homocentric (earth at center) spheres. Aristotle used this same universe of homocentric spheres but introduced some new thoughts. He believed the earth to be composed of earth, air, fire, and water, while the heavenly bodies were composed of a "quintessential ether" and had to maintain their position above the earth. All movement was motivated by a "Prime Mover" and beyond the star was a void: a finite, spherical universe surrounded by nothing. More observational data soon caused more difficulties and eventually Ptolemy "saved the phenomena" by a geometric scheme of interacting epicycles to account for the movements of the planets and of the earth.

During the Middle Ages, the barbarians with the connivance of the Church swept away the fruits of Greek science and the world reverted to mythology. By about the year 1000, myth had fallen into some disrepute among the powers-that-were. Unfortunately, it was the Aristotelian-Ptolemaic system resurrected by such medieval scholars as Thomas Aquinas and Roger Bacon, which came into favor while the eminently more logical universe of the Milesians and the Atomists lay ignored for several hundred years more.

The laborious ascent from the Dark Ages began with Nicolous Copernicus in the 16th century. His great contribution was to planetary theory rather than to cosmology. The sun was restored to the center of things and, although retaining Ptolemy's epicycles, he dispensed with some of the more confusing complications by allowing the earth to revolve around the sun. From a cosmological viewpoint, his contribution was negative rather than positive: he liberated cosmology from geocentrism.

Another feature of classical cosmology was overthrown by Thomas Digges, who proposed a radically new picture of an infinity of stars extending uniformly throughout an infinite universe.

PLANETARY FORMATION

Galileo, with his observational data and his defense of Copernicus, and Johannes Kepler, who finally destroyed Ptolemy's epicycles with his three laws of elliptical planetary motion, helped pave the way to the Newtonian universe. Newton himself, with his theory of universal gravitation, provided the unifying principle necessary to begin the formulation of a coherent picture of the universe.

"Newton speculated that 'if the matter were distributed through an infinite space...some of it would converge into one mass and some into another, so as to make an infinite number of great masses, scattered great distances from one another throughout all that infinite space. And thus might the sun and the fixed stars be formed...'"

Approaching more contemporary theories, we find Georges Louis Leclerc, Comte de Buffon, who originated the collision theory of planetary origin. He postulated a violent collision between our sun and some foreign celestial body of nearly equal size. This collision forced the whole system into rotation. As a result of this collision, stellar fragments were broken loose, were retained by the gravitational attraction of the sun, and continued to revolve around the sun as planets. The probability of the original collision occurring would seem to be very remote. It has been found, however, that this type of collision may be occurring as often as ten times per year in the universe, which, in terms of astrophysical quantities, is quite large.

In the late 1790's, the French mathematician, Pierre Simon, Marquis de Laplace, criticized the Buffon theory. His major objection was based on the fact that if the planets were formed in this way, they would exhibit elongated, elliptical orbits, rather than the slightly elliptical, almost circular orbits they actually describe. He postulated an internal explosion (nova or super-nova) of the sun in the past resulting in a gaseous sphere. He accounted for the rotation by assuming that the original rotation of the sun was transferred to the gases and thence to the planets. As the gases cooled and contracted, their rotational velocity increased, resulting in a centrifugal force. This would cause the separation of the rings of solar matter, which would immediately break up into large portions of matter. The result: rotating planets. Interestingly enough, Laplace never subjected his theory to mathematical analysis. It remained for J. C. Maxwell to attempt this. He tried to discover why, if Laplace was correct, the billions of small bodies which form the rings of Saturn do not form planets. He discovered that the shearing forces, (V) which exist due to a variation in angular velocities in different parts of the ring would have to be less than the gravitational force, (G), existing between the particles, for the planetary formation to occur. In this case, these conditions did not exist. This same situation would have existed in the ring around the sun, unless the mass of the material in it had exceeded the combined mass of all the planets now existing in our solar system by a factor of one-hundred.

Sir James Jeans, Thomas C. Chamberlin, and Forest R. Moulton formulated the modern collision or tidal theory. They postulated that, instead of an actual collision between two bodies, resulting in planets, the planets were formed by the tidal action on the sun of a star passing by. As the gaseous material was pulled away from the main body of the sun, it would have broken apart to become our planets.

In the early 1940's, Carl Von Weizsacker discarded the tidal theory and, on the basis of the discovery that the universe is not composed mainly of terrestrial elements, but is instead a 98% mixture of hydrogen and helium, returned to the Kant-Laplace theory. He reasoned that the gases around the sun dispersed into inter-stellar space and the particles containing terrestrial elements formed our planets by aggregating into larger and larger particles. This is the currently accepted theory of planetary formation.

THE CURVED SPACE-TIME CONTINUUM

The problem of describing the large-scale features of the universe has become largely a gravitational one, since gravitational forces are the only forces that exist between galaxies. The modern version of Newton's gravitational theory is Einstein's General Theory of Relativity with its curved space-time continuum. This curvature caused a little difficulty with the tools used in cosmological study, but with the development of non-Euclidian geometry, it was possible to continue with this work. Einstein theorized that the curvature of space must be independent of time but could not solve the proper field equations in such a way as to allow a static universe. He, therefore, postulated a new force acting between galaxies, independent of mass and increasing with increasing distance, which he called Cosmic Repulsion. The presence of this force permitted the existence of a closed universe with a positive curvature and with finite volume. In 1922, Alexander Friedman, discovered an error in the proof of Einstein's equations. He (Einstein) had divided both sides of an equation by a quantity which, under certain conditions, could be zero. Solving the equations correctly led to two possibilities: an expanding or a pulsating universe. A few years later, Edwin Hubble at Mount Wilson, in studying the Doppler Effect of "nebulae", thought to be in our galaxies, discovered that not only were these nebulae at great distances, they were rushing at a velocity proportional to their distance from us. He then postulated that the universe as a whole, was expanding.

Then a great contribution was made to cosmology (from the evolutionists' point of view) by Abbe Georges Lemaitre. He theorized that, at the beginning, all the matter there is now in the universe was compressed into a small, super-dense, super-hot "primival atom." When this atom reached a certain critical point, the primordial matter simply exploded, losing a cloud of electrons, protons, alpha particles, and other elementary radiation, with a greatly increased velocity. The rapid expansion of this cloud caused it to cool and coalesce into stars which, because of gravitational attractions, formed galaxies.

The steady-state universe has been theorized by Bondi and Gold on a physical basis and by Fred Hoyle on a mathematical one. Bondi and Gold have evolved a "perfect cosmological principle" which states that the universe is uniform not only in space but also in time. The steady-state of the universe is a consequence of this physical fact and the continuous creation of matter logically follows.

The universe, according to Hoyle, had neither a beginning nor will it have an end - it will, therefore, go on forever. He prefers to derive the steady-state as a consequence of his solutions to a certain set of field equations. In his solution to these equations, he considers fluid stresses which the evolutionary cosmologists ignore, and from this inclusion, he derives a solution which allows a steady-state universe. He then states that matter is being continuously created. (This contradicts the first and second

-Continued on page 22

INTRODUCTION TO PURE PNEUMATIC COMPUTERS

by Donald Abram Miller

Many devices in use today employ pneumatic elements in their control systems. One might immediately think of safety valves, pressure gauges, or the servo system of a pipe organ. Broad classifications of such devices include flapper-valve controllers, force-balance controllers, mechanico-pneumatic amplifiers, vane-and-jet controllers, and various types of transducers.

A new concept of computer elements is under development at the Diamond Ordnance Fuze Laboratories of the District of Columbia. Pneumatic devices have been made which require no moving parts. These devices can be assembled into systems capable of performing arithmetic and control operations.

It is known that scientists of the U.S.S.R., and other nations, have produced mechanico-pneumatic devices capable of performing arithmetic operations.

The following is only a brief description of pure pneumatic analogues to electronic circuit elements.

MOMENTUM EXCHANGE CONTROL TECHNIQUE

It is possible to deflect the flow of a fluid stream by injecting a second or control stream into the main one at right angles to its flow. The phenomena involved are similar to the action of billiard balls. The controlling energy need not be of the same order of magnitude as the controlled energy. The configuration of fig. 1 permits switching of the main flow between two states. This technique has been termed momentum exchange control and it permits amplification.

If some of the deflected flow were bled off and routed to an appropriate auxiliary jet, feedback would occur in such a way as to aid the control jet. This feedback is positive, i.e., it aids amplification. If the feedback flow is sufficiently large, the power jet will be locked in the deflected position even after the control jet has been turned off. This feedback technique is called momentum exchange feedback and it makes possible the digitalization of data. Mathematical computations can be achieved by suitable combinations of the above.

BOUNDARY-LAYER CONTROL TECHNIQUE

The side walls of the nozzle throat are stepped back suddenly after the orifice of the power jet. Gas molecules are entrained from this setback volume, or boundary-layer, and a low pressure region results. The pressure symmetry can be destroyed through injection of a control fluid into the low pressure volume on one side of the power jet. The unbalance produced causes the power jet to deflect away from the side on which the control fluid is being admitted. This is a boundary-layer control technique.

As the power jet deflects to one side, the entrainment increases on the near side and decreases on the far side so as to further increase the pressure unbalance. The mass flow or energy in the control stream for this technique is much less than that needed in the momentum exchange technique, i.e., there is more amplification. The pressure distribution will cause the power jet to remain reflected even after the control jet has been terminated. This technique is called boundary-layer lock-on.

The contours of the boundary walls can be varied in many ways to control the downstream characteristics and ability to feed back through the boundary layer. Blockage of the power jet path will cause deflection to the other available path. One can build units such that the power jet will return to its original path when the blockage is removed. Such is accomplished through the use of eddies. This represents one type of boundary-layer feedback.

SELECTIVE POSITION DESIGN TECHNIQUE

The above mentioned memory disappears when the power jet is turned off. However, units can be built so that they will always start in a preselected position when the power jet is turned on. This permits resetting a digital type pneumatic counter on command without losing the capability of pulse type input signals. This technique is termed selective position design.

The above techniques permit operations analogous to those of tubes or transistors. Additional circuit elements, and their electrical analogues, are:

porous plug — resistor
volume — capacitor
long, thin tube — inductance with distributed resistance.

With sufficient ingenuity, one can construct amplifiers, bistable elements, oscillators, and all the other elements needed to assemble a purely pneumatic computer.

It is to be remembered that these pneumatic devices operate without moving parts. They can be produced at costs of the order of, or less than, five times the cost of materials, by means of mass production techniques including molding, photo-chemical engraving, and others. The shelf life is indefinite. In cool gas systems, there is nothing to wear out. (High velocity, hot gases will cause erosion of the type found in gun barrels.)

Without need of special mounting techniques, pneumatic circuits can be made as rugged and reliable as some electronic counter parts are fragile. Such systems are comparatively insensitive to extremes of temperature, shock, vibration, and radiation. (A possible application could be found in computers capable of working through a near nuclear burst.)

The pure pneumatic systems are adaptable to very high density power supplies. Compressed gas, products of combustion, or even freestream

—Continued on page 22



Some straight talk

about a career

at American Oil

by Roger Fisher

"This Company recognizes the value of varied experience, and encourages you to broaden your knowledge."

Roger Fisher, B.Ch.E. from Cornell and Ph.D. candidate from Princeton is one of many young scientists and engineers at American Oil shaping the future for himself, his Company and the industry. At 26, he has earned a Fulbright Scholarship and will take a year's leave of absence to continue his graduate research on solids mixing at the University of Osaka, Japan.

"American Oil is looking for broad-gauge research people," Roger adds. "In the long run, the Company benefits as well as the professional who continues to grow in his own or in several fields of research."

Roger's present assignment at American Oil involves applied research—to plan, design, build and operate bench scale lab equipment, to study the kinetics of catalytic cracking. His is one of many diversified projects at American Oil Company. Chemists, chemical engineers, physicists, mathematicians and metallurgists can find interesting and important work in their own fields.

The ability of American Oil to attract bright young scientists and engineers like Roger Fisher might have special meaning to you. For complete information concerning career opportunities in the Research and Development Department of American Oil, write D. G. Schroeter, American Oil Company, P. O. Box 431, Whiting, Indiana.

IN ADDITION TO FAR-REACHING PROGRAMS INVOLVING FUELS, LUBRICANTS AND PETROCHEMICALS, AMERICAN OIL AND ITS ASSOCIATE COMPANY, AMOCO CHEMICALS, ARE ENGAGED IN SUCH DIVERSIFIED RESEARCH AND DEVELOPMENT PROJECTS AS:

New and unusual polymers and plastics • Organic ions under electron impact • Radiation-induced reactions • Physicochemical nature of catalysts • Fuel cells • Novel separations by gas chromatography • Application of computers to complex technical problems • Synthesis and potential applications for aromatic acids • Combustion phenomena • Solid propellants for use with missiles • Design and economics: New uses for present products, new products, new processes • Corrosion mechanisms • Development of new types of surface coatings



AMERICAN OIL COMPANY

NATIONAL MARKETING AFFILIATE OF STANDARD OIL COMPANY (INDIANA)



ALUMNI PAGE

Edited by

John Wolfgang



Do you remember drawing classes in Draper Hall or laboratories in the Corcoran annex.

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Are you "taking a job" or "beginning a career"?

*There's a mighty big difference
between the two*

As we see it, "taking a job" can be much like taking a single, tentative step in the dark. It may serve your purposes temporarily, but where do you go from there?

Young men who snap up tempting job offers often regret their decisions as time goes by. The plain fact is that glittering inducements sometimes cover up the lack of a future. But the man who thinks in terms of a *career* is not easily fooled; he sees his first job as a beginning, not as an end in itself.

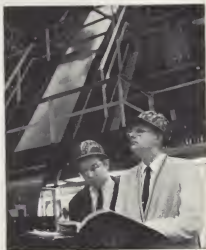
Careers with Bethlehem Steel—A doorway to careers with Bethlehem Steel is the Loop Course—its members make an observational circuit (or "loop") of a steel plant during their initial training program. Through the Loop Course, Bethlehem seeks *only* men who are interested in career opportunities. We do not accept men who are "just looking for a job"; and, by the same token, we do not assign loopers to "dead-end" jobs.

Promotion from Within—It is important to bear in mind the fact that, apart from the need for an occasional specialist, we fill management positions from within the organization.

The Loop Course, through its 40 years of operation, has provided about 2,000 selected and trained men, capable of advancing to positions of increased responsibility.

Loopers are Thoroughly Trained—New loopers report to our general headquarters, in Bethlehem, Pa., usually early in July. They attend a basic course of five weeks, including lectures, classroom discussions, educational films, and daily plant visits. The Loop Course is *not* a probationary period. After completion of the course, every looper receives his first assignment. Then, after reporting to a plant, yard, or home office division, he receives further orientation before beginning on-the-job training. Bethlehem loopers embark on their careers with thorough training behind them.

Big and Diversified—Because of its size and diversity of its operations, Bethlehem Steel offers unlimited opportunities to "get ahead." One of the nation's largest industrial corporations, with over 140,000 employees, we are engaged in raw materials mining and processing; basic steelmaking and the production of a wide range of steel



products; manufacturing; structural-steel fabricating and erecting; and shipbuilding and ship repair. We operate steelmaking plants on the Eastern Seaboard and the Pacific Coast; shipyards on the Atlantic, Pacific, and Gulf Coasts; manufacturing units and fabricating works in twelve states; and sales offices in most leading cities. A new centralized research facility, the Bethlehem Steel Company-Homer Research Laboratories, costing in excess of \$25 million, located in Bethlehem, Pa., rivals the finest in any industry.

Read Our Booklet—The eligibility requirements for the Loop Course, as well as a description of the way it operates, are more fully covered in our booklet, "Careers with Bethlehem Steel and the Loop Course." It will answer most of your questions. Copies are available in most college placement offices, or may be obtained by writing to Manager of Personnel, Bethlehem Steel Company, Bethlehem, Pa.

All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.



BETHLEHEM STEEL



ENGINEERS' DAYS

Under the able chairmanship of Dulaney de Butts, the School of Engineering sponsored Engineers' Days on February 23 and 24. These days were chosen to coincide with National Professional Engineers Week of February 19-24. The School was opened to visitors and guided tours were conducted during both days to show guests the main points of interest of the school — exhibits by engineering students and by local national industrial companies.

The purpose of holding Engineers' Days was an attempt to alleviate an undesirable situation pertaining to enrollment in engineering schools. On a national basis the freshmen enrollments in engineering since 1957 have decreased about 20 percent while the demand for graduate engineers has shown a marked increase for the corresponding period. While this was not an attempt to aggrandize the work of the engineer or the engineering student, a concerted effort was made to show what goes on in engineering schools and what is to be expected after graduation. The greatest effort was expended in reaching high school seniors in the Washington area.

The guests that came saw exhibits which were in two major categories. The two categories manifested an attempt to show what the student does in obtaining an engineering degree and then what he can expect to do with it as a professional engineer. The students attempted to show all aspects of engineering education by opening laboratories and classrooms to high school students. Visitors were encouraged to sit in on classroom lectures in order that they may grasp a better idea of the material which they would study as engineering students. The laboratories contained exhibits of experiments that are actually performed by students. The industrial displays showed, primarily, what technological advancements are being attained in engineering applications today. The exhibits and displays were controlled by the three student branches of the Professional Engineering Societies: the ASME, the AIEE-IRE, and the ASCE. Naturally the societies were responsible for exhibits and laboratories in their general field of endeavor.

ASME

The ASME's were responsible for some of the more impressive exhibits pertaining to many facets of engineering. A very informative and interesting exhibit was sent by NASA showing prototypes of the Explorer and Paddle-wheel satellites. Since these were scale prototypes, they gave a very good idea of just what our satellites are actually like. NASA also sent a plastic model of the new Goddard Space Flight Center showing various testing facilities including the

vacuum chamber and space environment testing unit. Also, an Exhibit by Martin-Marietta depicting the problems encountered in meteorology in space was displayed. Jansky and Bailey, in cooperation with Atlantic Research Corporation, showed the use of inflatable antennas in instrument landings of aircraft. Atlantic Research Corporation also had on display one of their sounding rockets used for the purpose of obtaining information about the earth's atmosphere. International Business Machines supplied an informative exhibit on micro-miniaturization of electric circuits and also on research into low temperature characteristics of materials.

In another group two other exhibits were shown and explained by members of ASME. Allis-Chalmers provided an exhibit on fuel applications in fuel cells and nuclear reactors. A working model of a fuel cell was demonstrated which oxidized alcohol using hydrogen peroxide and produced a low voltage high current source. These cells operate at 80 percent efficiency and banks of them are being used experimentally to power farm tractors. As an alternative power source to fuel cells, three nuclear reactor models were presented. Two were experimental and training swimming pool reactors and the other was a boiling water power generation reactor. The National Plastic Products Company provided a display on the production and use of saran plastic. The display showed how sea water and petroleum were used to produce finished products such as cloth, rope, rugs, lawn chairs, etc. The students also exhibited a gas turbine and a solar cooker as projects from Mechanical Engineering Laboratories. The Metallurgy Laboratory was open to show how specimens are prepared for examination and what can be done to improve properties of materials as a result of this examination.

AIEE-IRE

Firms engaged in electrical and electronic work also were helpful in providing displays. The National Bureau of Standards provided a measurements exhibit showing difficulties encountered in making precision measurements under extreme conditions. Deco Electronics provided models of two very advanced types of antennas. The first model showed the Navy's VLF transmitting facility at Cutler, Maine, which is used in Polaris submarine communication. The second Deco model was a TAHA very directional antenna built for the U. S. Army Signal Corps.

The electrical engineering students maintained several laboratories open and a variety of demonstrations showing work done in advanced courses. The Power Lab, Electronics Lab, and

Feed-back Control Lab were kept open to show various equipment. A demonstration on the operation of radio station WRGW was given along with a precision 2.5 megacycle receiver for receiving WWV reference frequency for the Meteorology Laboratory. Two other experiments were a light sensor and a radio frequency quadrupler that changes the carrier signal but not the program content. The automatic computer Flac II was shown and its general principals of operation explained.

ASCE

Civil engineering industry produced several displays designed to show the projects accomplished by present day engineers. Bethlehem Steel provided an exhibit showing how steel is produced from raw materials and what could be expected of the finished product. Tecfab Inc. demonstrated the practical importance of using lightweight aggregates of volcanic ash. This light-weight concrete can then be extruded into wall size panels containing window and door frames for prefabrication of concrete buildings. The Bureau of Roads supplied a hydrologic cycle exhibit showing the effective use and control of our water resources. A far reaching display on city planning was composed by the National Capitol Planning Commission, Downtown Progress Committee, Maryland National Capitol Planning Commission, and the Northern Virginia Region Economic and Planning Commission. This was a very complete exhibit projecting to the year 2000 and showing how to cope with expected problems. The central theme of the exhibit was to show how engineering fits into planning along with thirteen other divisions of higher education.

The civil engineering students operated several interesting laboratories and exhibits. The soils laboratory contained exhibits on soils testing and grading and an experiment in soil stabilization through electro-osmosis. The Stress Analysis Lab showed important considerations concerning the three-hinged arch and various methods of analysis. Also in this laboratory was a project in stress analysis by photoelasticity. This consists of making a clear plastic model of the configuration to be examined and then shining light through it while subjecting it to stress. The strain will then show up as a result of the diffraction of light rays. In the Concrete Lab a concrete diving board was exhibited showing the potential elasticity of concrete. Also in this laboratory concrete specimens were broken at specified times to provide a rather spectacular example of destructive testing of materials. The fluid mechanics laboratory contained two interesting examples of fluid flow. Smoke tunnel flow around various obstructions was demonstrated using a conventional smoke tunnel. An open channel characteristic known as the hydraulic jump was demonstrated to give insight into the conservation of momentum principle.

GRATIFYING RESULTS ACHIEVED

Despite the fact that an enormous amount of energy was expended by students on Engineers' Days, the general feeling is that it was well worth the effort. Approximately 500 guests, comprised mainly of high school seniors, toured Tompkins Hall and apparently most of them were favorably impressed. In the knowledge that our decrease in enrollment has been somewhat less than the national average, we can build our school at a much greater rate than other schools not holding Engineers' Days. Of course, the progress made will be largely dependent upon the success of the Engineers' Days here.

Several important ramifications were made manifest during the organization of Engineers' Days that may affect the desired results. Probably the most important and discouraging result is the lack of liaison among students. Class time contact seems to be the only possible way to communicate with students and even this sometimes does no good. There is a definite need for greater awareness of the students' role in the engineering profession. It was pleasantly discovered that the student societies and the professional societies can be depended upon for help. Another pleasant discovery was that the alumni are willing to help even though the percentage of active alumni is small. It was found that this was a tremendous aid and it is hoped that this means of assistance will be exploited more next year. The co-ordination of an interested student body and an active alumni association can do much to make the results more gratifying next year.

As a fitting conclusion to this years' festivities, the Engineers' Ball was an impressive social success. Although attended by only 150 people this represented a considerable increase over previous years. As a measure of compensation, slide rule widow certificates were awarded to the wives of the engineering students and faculty. The highlight of the evening was the crowning of Jan Larkins as the 1962-1963 Engineers' Queen. The evening was a notable success and enjoyed by all who attended.

In conclusion, the 500 percent increase in guests over last years results was due to several things. The advance publicity was very extensive and included radio, press, postal correspondence, and personal contact. The many varied exhibits allowed greater publicity and left valuable impressions on all who viewed them. The participation of the student branches of the societies as a group effort rather than individual effort presented a more unified venture. If all of the information procured from the operation is evaluated and refined the Engineers' Days of the future can be the focal point for the building of a great engineering institution as a part of The George Washington University.



What's Cooking?



Lee Kaminetzky demonstrates a hydraulic jump for some surprised visitors.



High school students visit Tompkins Hall.



Dulany deButts explains how George Washington expansion will keep pace with city planning.



Pat Poindexter tests pre-stressed diving board for the C. E. Department.



School of Engineering Graduate 1978

CAMPUS NEWS

ASCE

At the February meeting of the ASCE, the officers for the coming year were elected.

President: Allyn Kilsheimer
Vice President: Nick Paleogelos
Secretary-Treasurer: Barry Blumberg

It was announced that the Regional Conclave of the National ASCE will be held on Saturday, April 7, at the rate of \$1.00 per person. Included in the activities will be a trip to Dulles International Airport, and a luncheon, during which participants will meet members of the parent chapter.

ASME

The main point of the February meeting of the ASME was the talk given by Mr. Reed Jenkins of NASA. Mr. Jenkins spoke on Sounding Rockets, giving the importance of them for research into various types of information, such as temperature ionization, atmospheric pressure, and types of particles.

This month, the ASME is holding its annual technical paper contest. A total prize of \$50.00 has been given from the John Cannon Fund and will be awarded to the best papers. The top winner will have the opportunity of going to Lehigh University to present his paper for the regional award.

AIEE-IRE

During the break between semesters, a trip through Goddard Space Flight Center in Greenbelt, Maryland, was arranged. Mr. Rochelle, who has spoken at one of the previous branch meetings, guided the group of fifteen through the satellite division, showing them models of nearly all the satellites put into orbit thus far and a few not yet completely developed. He included a tour of the telemetry division of Goddard, during which several small laboratories were opened to the group. Then, Mr. Van Allen took over, taking the group to other areas, among which was the huge materials testing laboratories building. In this building, prototypes of each satellite are tested to see how they will stand up under the unusual conditions of upper atmospheric and spacial travel. After lunch at the Goddard Cafeteria, the group went to the conference room where a film was shown on one of the satellites built by the Center. The final event was a tour of the computer and tracking department. This department is most directly connected with Cape Canaveral and other parts of the world-wide space network.

Another activity of the AIEE-IRE was the annual Prize Paper Contest, held during the February meeting. The contestants, the subjects of their respective papers, and the first, second, and third place winners are as follows:

David Lokerson, second place -- The Design of a Narrow Band 2.5 mc Standard Frequency Radio Receiver

by Judy Popowsky

Donald Lokerson -- Satellite Trail Ionization-A New Means of Communication and a Source of Knowledge

Donald Miller -- Some Results on Frequency Modulation of One Multivibrator Circuit
Edward Levitt, first place -- Automatic Coded Character Sequence Recognition

Janko Jackson -- Flying Spot Scanner
Larry Hice, third place -- New Concepts of Transmission Line Design for High Power

It is to be understood that the papers have only been judged on the oral presentation, and that the final winner will be announced after the written papers are judged and the total scores are computed.

The judges, Mr. Fifer, Mr. Kelly, and Mr. Hermack, are, respectively, the president, vice president, and student activities committee chairman of the Washington Section of the AIEE.

The third event connected with the AIEE-IRE was the annual IRE Banquet, at which, traditionally outstanding members of all the student branches in the area are presented with awards. The winner of the National IRE Award was Mr. John Wolfgang, this year's Student Branch Chairman; the winner of the Washington Section Award was Mr. Marvin Fox, the Student Branch Vice-Chairman. The recipients of the award were chosen on the basis of scholastic record and service to the Branch. The banquet and dance was also attended by last year's recipients, David and Donald Lokerson, and by Judith Popowsky and Harvey Flatt, who acted as ushers for the entire event.

SIGMA EPSILON

Sigma Epsilon held its initiation and banquet on Sunday, March 4, 1962. The new members of this honor society are: John Calarco, Donald Eddins, Harvey Flatt, Erling Jacobson, and Frank Klisch.

SIGMA TAU

The Xi Chapter will hold its Spring Initiation Banquet and Ball at the Holiday Inn on April 14, 1962. Sixteen students of the engineering school are eligible for membership and are now being pledged: Carlos Alonso, Alan Bomberger, John Calarco, Jerry Edwards, Ivan Kavrukov, Vernon Krueger, Marshall Levitan, Jaong Lee, Donald Lokerson, Robert McCalley, Ajit Ratra, Stephen Rich, Richard Singer, Marvin Spivak, Bobby Sprinkle, and William Swinney.

THETA TAU

On the 23rd of February, Theta Tau held its pledge mixer at the home of Ray Morales. The purpose of the mixer was to allow the pledges to become acquainted with the members.

The winning bridge team, Harvey Flatt and Doug Jones, barely nudged out their opponents by earning a total of 3600 points to 0. At the same time, John Wolfgang relaxed to the banjo and guitar music of Herb Wilkinson, Tom Herz, and John Pyle.



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Hydrofoil ships...another engineering challenge!

Such a revolutionary concept in sea-going design represents still another major challenge for today's engineers. Through their careful and creative planning, this hydrofoil ship will move from the drawing board to reality. One such vessel, now under development, is planned to travel 100 miles an hour. It will skim over the tops of waves like a flying fish,

lifted aloft by a set of underwater wings.

Through the intensive research of the metallurgical engineer will come a metal for these hydrofoils, strong and tough enough to stand up to difficult underwater service. A metal which will resist corrosive attack by the coursing brine, cavitation from the seething turbulence, stresses and strains from

the load of the ship.

An engineering career, such as metallurgy, is full of challenges. Exciting new designs—gas-turbined cars, nuclear-powered ships, monorail transit systems—all will be in your range of exploration, affording you a great opportunity for advancement in a profession that promotes progress and economic growth.



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MECH MISS

Jan Larkins

This month the ASME'S showed definite good taste in picking Jan Larkins as their Mech Miss. The sentiments of ASME were echoed by the engineering students when they elected her Queen of the Engineers' Ball, held on February 24, 1962.

Jan is a senior majoring in speech at G.W.U. and also works for the speech department. Her major interest is drama, which is well attested to by the fact that she has had the lead in the last two homecoming plays, "The Boy Friend" and "The Pajama Game". In addition, she sings in the Glee Club and the Traveling Troubadors, and she has journeyed with them to New York's Radio City Music Hall and to the armed forces bases in Greenland and Canada. While she was in New York, she was the subject of an article appearing in Look Magazine, "A Coed in New York".

Jan belongs to Kappa Kappa Gamma, and she was recently selected as a member in Who's Who.



by Donald Abram Miller



Farrington Electronics, Inc., with facilities nearby in Alexandria, Virginia, has several machines which offer improvements in data processing through character recognition. The machines, which utilize an optical scanning technique, represent an advance over systems which employ magnetic or other coding techniques.

Magnetic scanning (the technique used now by many banks to process checks) necessitates special printing equipment, special inks. Also, since one can scan only vertically in the magnetic system, only certain character styles can be recognized. To make certain characters distinguishable, it is necessary to reshape them somewhat to produce different waveforms in the sensing circuit.

The optical technique used by Farrington does not require special inks or special paper. It can be used to recognize characters printed by a wide variety of commercial typewriters and adding machines.

A simplified description of the optical scanning technique is as follows: A document is fed at a uniform rate past the reading station, where it is brightly illuminated. The reflected image of the document is projected through a scanning disk onto a multiplier phototube by a series of lenses and a mirror. The disk contains a number of radial slits which pass at high speed in front of a fixed slit. As the slits intersect, a ray of light normally passes through to the tube; when

a portion of a character is read, however, the light beam is obstructed and the tube produces a "black pulse". A two dimensional scan of the information is thus obtained from what effectively constitutes a "flying aperture".

The output of the phototube indicates the presence or absence of a part of the character at any particular spot. The over all resultant signal wave-forms show the exact position of each part of the whole character. The signal interpreter is a special-purpose, small-scale digital computer that examines the pulses and looks for various pulse patterns which are significant in isolating the identity of the characters.

After the characters are recognized, the information can be punched onto the original document, if it is a card (some billing systems do this), or it can be fed to a variety of output equipment. For instance, the data can be transferred to cards or tape for purposes of a high speed read-in to a large computer.

Another advantage of the system is that the signal interpreter can be reprogrammed to recognize different type styles with little or no changes to the optical scanner being necessary.

Reproduced below is a sample of the type style that can be recognized by one of these scanners. This is a distinct advantage over earlier systems of data processing, which required esoteric codes.

This electronic wonder performs the same function you are performing now; it reads this type style, upper and lower case alphabetic characters, common punctuation marks, and numeric characters, 0123456789. Model IPSP has ability either to read full pages of typewritten information, single or double-spaced, or to scan entire pages in search of particular information, further translating it into a punched paper tape code. Whether the 5-level or the 6-level code is used, the page reader scans and punches 240 characters per second, automatically feeding from page to page. Among the many potential uses, the IPSP offers automated systems in such areas as communications transmission, typesetting, data reduction, scientific literature abstraction, catalog-indexing and language translation.

Laws of Thermodynamics, i.e., if energy and matter are conserved, from where does the energy come?) He theorizes that all of space is filled with a tenuous gas, originally pure hydrogen, from which galaxies condense.

Since our universe is expanding, an evolutionary universe with irreversibly evolving galaxies would result in a drifting apart of these said galaxies until eventually, each would be "alone" and "dead" in space. Hoyle, on the other hand, believes that new galaxies are constantly being formed at a rate which would compensate for those which are leaving the observable universe as a result of expansion. As a consequence, new "background material" appears to be created at such a rate so as to compensate for that being condensed: the continuous creation of matter. Hoyle contends that the "... matter that already exists causes new matter to appear" due to the existence of a creation field. This new material would also, according to Hoyle, produce a pressure that would lead to steady expansion and also force the condensation of galaxies.

If the universe is in a steady-state, some fundamental laws of physics are being disobeyed. The conservation of matter and energy is disregarded in the Steady-State Theory. On the other hand, if the universe is not steady-state, why does space not become more sparsely populated? Hydrogen, agreed by all as the original matter, still exists, so does it not follow that the hydrogen we have today is newly formed? The other galaxies we can see seem to be young. Does it not follow that the older ones have drifted into infinity? Red-giants of a young age abound in the universe, and cosmologically speaking, they have short "lives," so doesn't it follow that they are newly created from newly created matter?

THIRTY MINUTES!

Mainly in answer to these queries, but also in an effort to present a more logical and simplified theory on the evolution of the universe, George Gamow has postulated his widely accepted Theory of an Evolutionary Universe. His views

are essentially those of Lemaitre: that there was a time when radiant energy was greater than matter, but after a period of time, the density of matter became greater than the mass density of radiation energy. The compressed gas then broke up and began to drift apart as proto-galaxies, which eventually condensed into separate stars. After the explosion, or "big bang", as Gamow calls it, things cooled down enough so that the protons and neutrons could associate and eventually form atoms and finally molecules. Rather than holding a belief in a steady-state universe with matter being continually created, such as in Hoyle's theory, Gamow believes that most of the elements were created five billion years ago during a time lapse of roughly thirty minutes! The heavier elements were built up in this way (neutron capture). The absence of a stable element of atomic weight five, is the only loophole the "Hoyleists" have been able to find in the Gamow theory. Gamow, however, merely amends his theory to read: Some of the heavier elements were formed by neutron capture, but others were created later in the interior of other young stars. Lincoln Barnett describes quite well our future in Gamow's evolutionary universe:

"... the substance and energy of the universe are inexorably diffusing like vapor through the insatiable void. The sun is slowly but surely burning out, the stars are dying embers, and everywhere in the cosmos heat is turning to cold, matter is dissolving into radiation, and energy is being dissipated into empty space ... maximum entropy will be reached."

To form a conclusion as to the correct theory, acceptable to all, we must be able to turn back time and to penetrate to the outer fringes of our own galaxy - and finally to the fringes of the whole universe of which our galaxy is but a small part. The first of these conditions we may never be able to achieve. The second, however, seems more plausible and has been brought closer to the grasp of the restless spirit of mankind.

INTRODUCTION TO PURE PNEUMATIC COMPUTERS—Continued from page 6

pressures from the environment could serve as the analogues to batteries and generators. (Free-stream pressures can also be used directly as input data, without need of transducers.)

The most significant anticipated limitation for pneumatic systems is that of frequency. Although the principles involved permit easy achievement of low frequency components, they also place an upper limit. The practical upper limit for generators seems to be on the order of one hundred kilocycles per second (due to energy loss levels and impedance matching problems.) For most systems, the upper limit will probably be less than 20 K.C. The upper frequency limits are functionally dependent on fluid temperature, fluid thermodynamic properties, and physical size of components.

OTHER APPLICATIONS

Pneumatic elements are not limited to computers for their applications. What may well be the most significant property of these elements

is that many applications will require no transducers, as in the case of electronic control systems. The medium under control may serve as both the power source and the operating medium of the control system.

As an example of direct control applications, consider the earlier discussion in conjunction with the diagrams. One might substitute a rocket exhaust for the power jet. Steering of the rocket could be accomplished with less energy loss than in the case of mechanical systems by application of flow vectorization. The exhaust could be tapped for operating power with no need of generators (transducers) to waste energy. Or, for vehicles operating within the atmosphere, the relative motion of the air could provide the operating power for the pneumatic system.

In summary, the research in the field of pure pneumatic devices and pneumatic computers represents a significant breakthrough in the "state-of-the-art", a breakthrough that should have far reaching effects in both military and civilian engineering practices.

how quiet is quiet?

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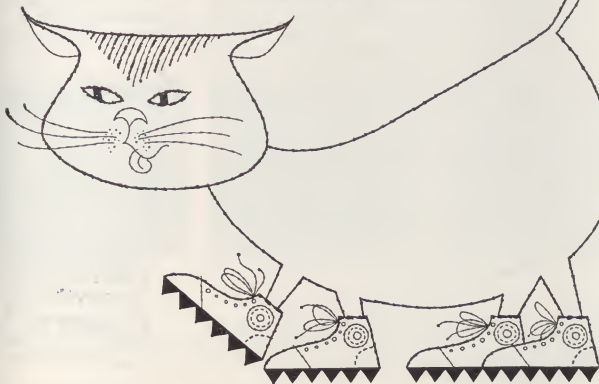
This scientific approach to silence is but a tiny facet of the many-sided program of pure and applied research which goes on daily at Ford Motor Company. *It is another example of Ford's leadership through scientific research and engineering.*



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Getting a Joke Column is Rough. If it's funny enough to tell, it's been told; if it hasn't been told it's too clean; and if it's dirty enough to interest an engineer the editor gets kicked out of school.



ODE TO A LAB REPORT

When I grow old and even older, I'll never forget that manila folder.

Bane of existence, object of hate, Never less than three weeks late. Title, object, method, theory, The clock strikes one, my eyes are bleary.

If I could have my preference, I'd never use a reference, ENGINEERS ARISE — let's storm the fort

Abolish forever the lab report!

Perry Mason: "And you mean to say that you had sixteen beers and didn't move from the table the night of the fight?"

Freshman: "I hate this damn place."

Sophomore: "It could be worse."

Junior: "It's rough, but think of the future I'm building!"

Senior: "I hate this damn place."

The day after finals a disheveled M.E. walked into a psychiatrist's office, tore open a cigarette, and stuffed the tobacco up his nose.

"I see you need some help," said the startled doctor.

"Yeah," agreed the M.E. "Got a match?"

Our faculty is reluctant to believe that anyone would cheat on exams, but one professor did become somewhat suspicious when several of the finals handed in for one class had been mimeographed.

The editor of this page points with pride to the clean, white spaces between the jokes.

Just in time for the last set of finals, MILLER INDUSTRIES, LTD. announced a special Voodoo kit for students. It contains a doll fashioned after one's favorite professor, plus six large pins. The pins are stuck in the professor and the doll is guaranteed to suffer.

Two aggies at Md. U. crossed a rooster with a rooster. They got a very cross rooster.

Engineers are continually surprised to find that girls with the most streamlined shapes offer the most resistance.

"She isn't my best girl — just necks best."

Said one vector to another, "I don't know your magnitude, but your phase is familiar."

A man sat at the bar rail all night and, when he was ready to leave, crawled up the wall, across the ceiling, down the wall and out the door. One patron asked the bartender, "Isn't that fellow pretty odd?" "Yeah," said the bartender, "he never says good-night."

The one who thinks our jokes are poor would straight-way change his views could he compare the jokes we print with those we do not use.

Statistics show there are three classes of coeds; the intellectual, the beautiful, and the majority.

DEFINITION: Can-Can; the place where you put your garbage-garbage.

A C.E. went to the student infirmary.

"Doc," he said, "I feel so terrible it makes me want to kill myself."

"Now, now," said the doctor. "You leave that to us."

And there was the heart rending case of the man who spilt a whole bottle of hair restorer on his head and smothered before he could get to a pair of scissors.

Army doctor: "Have you any physical defects?"

Selectee: "Yes sir, no guts."

Salesman: "Sir, I have something that's guaranteed to make you the life of the party, allows you to win friends and influence people, helps you forge ahead in the business world, and generally makes life a more pleasant and invigorating experience."

Engineer: "I'll take a quart."

We understand that the Russians have invented a new form of Russian roulette. Two people go into a room with a case of vodka. Each one drinks half. One person leaves the room. The other one then tries to guess which Russian left.

Sometimes those record companies can go too far. Have you heard the new just out? ALBERT SCHWEITER SCHWINGS.

SURPRISE!

Hidden away in the joke page are several new (or so we think) jokes, contributed by our readers. Let's start something. Let's have the other magazines stealing from our joke page. Put written contributions in the MECHELECIV mail box in the D. H. House. Contributor's name will be included if requested.

**DRAFTSMEN'S
SUPPLIES**

MUTH

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TRY MUTH FIRST

Kodak beyond the snapshot...

(random notes)

Deep in lacquer

That our name is never seen on a can of lacquer doesn't mean we aren't in it pretty deep.

Our newest cellulose ester for the lacquer formulators has the butyrylated, acetylated cellulose chains running much shorter than heretofore. This results in higher solubility, which means less solvent needed. It also means poorer film strength, but that's OK. A butylated urea-formaldehyde resin, included at the right proportions in the formulation along with the proper catalyst, will cross-link to the cellulose acetate butyrate during the drying of the coating. To provide a point of attachment on the cellulose chain, we restore one out of 12 of its hydroxyls. This condenses with the butoxy groups of the butylated urea-formaldehyde polymer to split out butyl alcohol.

Thus the short chains that are more soluble in the can become very much less soluble in the finish of a table on which some gay dog has set down the cup that cheers. No longer need a drop of lotion spilled on the dresser trouble the conscience of a good woman.

In these days of epoxies, silicones, methacrylates, polyesters, etc., why do we monkey with cellulose? What a silly question!

For one thing, we have shown how admixture of cellulose acetate butyrate can improve them all.

For another, cellulose is by far the world's most abundant high polymer. It is formed by sunshine.

The happy eye



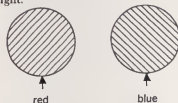
This is the *Kodak Carousel projector*. It projects slides. Carousels symbolize carefree abandon. Care lest slides jam can be abandoned. Gravity feeds them. Gentle gravity. Slides are automatically lifted back to 80-slide storage tray. Pushbuttons at end of long cord advance slides, reverse, even refocus. (Latter is largely for kicks. Slides get prewarmed not to pop out of focus.) See Kodak dealer for exact price.

First, though, consider the picture below. It's an experimental viewing device. An image is projected on a translucent screen. No matter how sharp the original picture, the simple machinery behind the screen can *always* improve the sharpness. It integrates out optical noise. It also makes the screen more pleasant to stare at. Some very purposeful staring is being done today.

Our long research on human vision has more than happy-time slides in mind.

Overlap in black

What would you say to a photographic paper that comes out red or blue—depending on the color of the exposing light.



and black where they overlap?



We are currently advertising around in various technical journals like *Geophysics*, *Materials Research and Standards*, etc. to ask if anybody would be interested in buying some rolls of paper like that for experimentation. It might be useful in interpreting the readings of certain kinds of instruments. You never know till you ask.

Note: Whether you work for us or not, photography in some form will probably have a part in your work as years go on. Now or later, feel free to ask for Kodak literature or help on anything photographic.



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Interview with General Electric's Dr. J. H. Hollomon

Manager—General Engineering Laboratory



Society Has New Needs and Wants—Plan Your Career Accordingly

DR. HOLLOMON is responsible for General Electric's centralized, advanced engineering activities. He is also an adjunct professor of metallurgy at RPI, serves in advisory posts for four universities, and is a member of the Technical Assistance panel of President Kennedy's Scientific Advisory Committee. Long interested in emphasizing new areas of opportunity for engineers and scientists, the following highlights some of Dr. Hollomon's opinions.

Q. Dr. Hollomon, what characterizes the new needs and wants of society?

A. There are four significant changes in recent times that characterize these needs and wants.

1. The increases in the number of people who live in cities: the accompanying need is for adequate control of air pollution, elimination of transportation bottlenecks, slum clearance, and adequate water resources.

2. The shift in our economy from agriculture and manufacturing to "services": today less than half our working population produces the food and goods for the remainder. Education, health, and recreation are new needs. They require a new information technology to eliminate the drudgery of routine mental tasks as our electrical technology eliminated routine physical drudgery.

3. The continued need for national defense and for arms reduction: the majority of our technical resources is concerned with research and development for military purposes. But increasingly, we must look to new technical means for detection and control.

4. The arising expectations of the peoples of the newly developing nations: here the "haves" of our society must provide the industry and the tools for the "have-nots" of the new countries if they are to share the advantages of modern technology. It is now clearly recognized by all that Western technology is capable of furnishing the material goods of modern life to the billions of people of the world rather than only to the millions in the West.

We see in these new wants, prospects for General Electric's future growth and contribution.

Q. Could you give us some examples?

A. We are investigating techniques for the control and measurement of air and water pollution which will be applicable not only to cities, but to individual households. We have developed, for

example, new methods of purifying salt water and specific techniques for determining impurities in polluted air. General Electric is increasing its international business by furnishing power generating and transportation equipment for Africa, South America, and Southern Asia.

We are looking for other products that would be helpful to these areas to develop their economy and to improve their way of life. We can develop new information systems, new ways of storing and retrieving information, or handling it in computers. We can design new devices that do some of the thinking functions of men, that will make education more effective and perhaps contribute substantially to reducing the cost of medical treatment. We can design new devices for more efficient "paper handling" in the service industries.

Q. If I want to be a part of this new activity, how should I plan my career?

A. First of all, recognize that the meeting of needs and wants of society with products and services is most important and satisfying work. Today this activity requires not only knowledge of science and technology but also of economics, sociology and the best of the past as learned from the liberal arts. To do the engineering involved requires, at least for young men, the most varied experience possible. This means working at a number of different jobs involving different science and technology and different products. This kind of experience for engineers is one of the best means of learning how to conceive and design—how to be able to meet the changing requirements of the times.

For scientists, look to those new fields in biology, biophysics, information, and power generation that afford the most challenge in understanding the world in which we live.

But above all else, the science explosion of the last several decades means that the tools you will use as an engineer or as a scientist and the knowledge involved will change during your lifetime. Thus, you must be in a position to continue your education, either on your own or in courses at universities or in special courses sponsored by the company for which you work.

Q. Does General Electric offer these advantages to a young scientist or engineer?

A. General Electric is a large diversified company in which young men have the opportunity of working on a variety of problems with experienced people at the forefront of science and technology. There are a number of laboratories where research and advanced development is and has been traditional. The Company offers incentives for graduate studies, as well as a number of educational programs with expert and experienced teachers. Talk to your placement officers and members of your faculty. I hope you will plan to meet our representative when he visits the campus.

A recent address by Dr. Hollomon entitled "Engineering's Great Challenge—the 1960's," will be of interest to most Juniors, Seniors, and Graduate Students. It's available by addressing your request to: Dr. J. H. Hollomon, Section 699-2, General Electric Company, Schenectady 5, N.Y.

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